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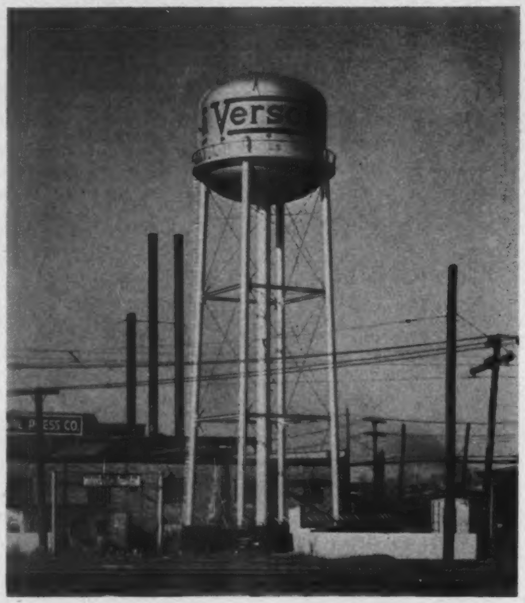
CENTENNIAL OF ENGINEERING

WSE MEETINGS—PAGE 3

NOVEMBER, 1951

Vol. 4 **No. 3**

100,000 GALLON ELEVATED TANK



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This 100,000-gallon Horton elevated steel tank maintains gravity water pressure in the automatic sprinkler system at the Verson Allsteel Press Company plant in Chicago. The plant consists of five buildings covering eight acres and containing 350,000 sq. ft. of floor area. The automatic sprinkler system has 1600 heads and covers 90 per cent of the floor area.

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Serving the Engineering Profession

NOVEMBER, 1951 — Vol. 4, No. 3

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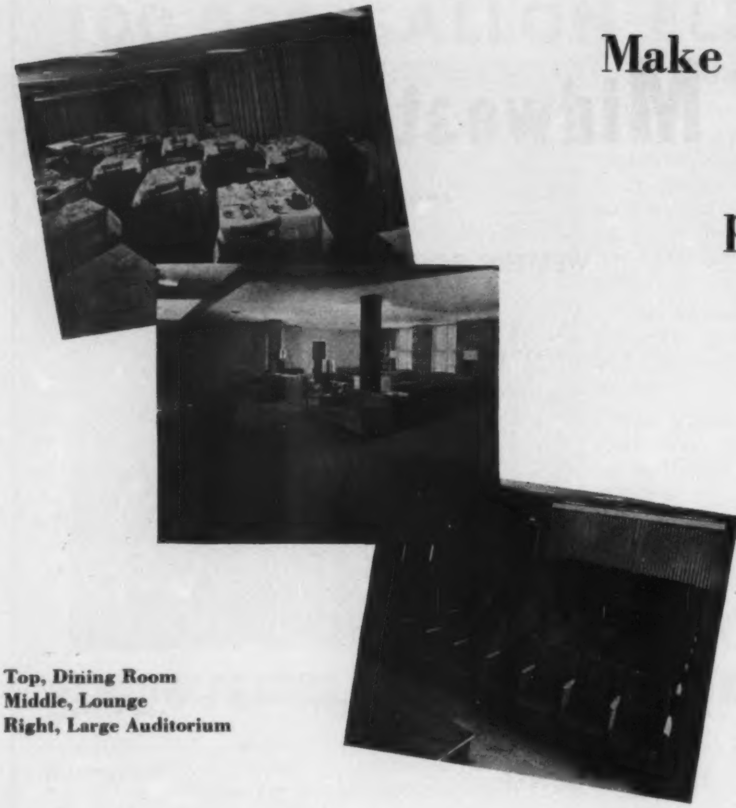
COVER LEGEND

Early Winter in a Chicago Park



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- ***Dinner- 5:30 p.m. - 8 p.m.***

Headquarters of The Western Society of Engineers

this month at WSE

COMING EVENTS OF INTEREST TO ALL MEMBERS

December 17 Meeting

An interesting meeting is being arranged by the Gas, Fuels and Combustion Engineering Section but plans were not completed as we went to press.

* * *

December 19 Luncheon

Raymond J. Budinger, chief of the Right of Way Division of the Cook County Department of Highways is scheduled to be the speaker at the December 19 Wednesday noon luncheon. Mr. Budinger's topic will be the "Trials and Tribulations of a Right of Way Engineer."

* * *

December 24

Christmas Eve — No Meeting

December 26

WSE Luncheon Meeting — Cancelled

December 31

New Year's Eve — No Meeting

January 2

WSE Luncheon Meeting — Cancelled

* * *

Yearbook Publication

Due to labor problems beyond our control, the Yearbook originally scheduled as a supplement to the November issue, will be published in December and should be in your hands before the first of the year. Your indulgence has been appreciated.

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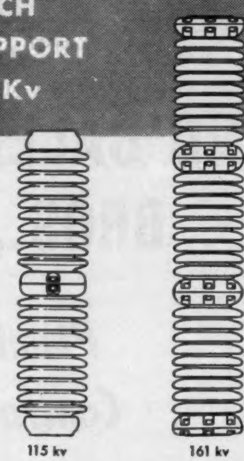

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Frank W. Edwards Named General Manager of Centennial of Engineering and President of Chi Epsilon Alumni

The Fall meeting of the Chicago alumni chapter of Chi Epsilon was held October 18 at the WSE headquarters.

This meeting, the third of the newly organized group, saw the election of the following officers for 1952:

President, Frank W. Edwards; vice president, Richard B. Berry; secretary-treasurer, Charles Macur.

Mr. Edwards, head of the Civil Engineering Department at the Illinois Institute of Technology is on a year's leave of absence to serve as general manager of the Centennial of Engineering. In a brief speech of acceptance, Mr. Edwards announced plans for a membership drive to be held in January.

Plans for the Centennial of Engineering to be held in Chicago next summer have taken another step forward with the appointment of Frank W. Edwards, director of the department of civil engineering at Illinois Institute of Technology and nationally known hydraulic engineer, as general manager.

Selection of Mr. Edwards, who has been granted a leave of absence to direct the $1,000,000 celebration which will be of international proportions, was announced by its president, Lenox R. Lohr.

Mr. Edwards, who is also secretary of the National Conference of Industrial Hydraulics, spent the 13 years prior to 1946 as a civilian executive with the U. S. Army Corps of Engineers. He was chief of special hydraulic structures for flood control at Los Angeles; chief of the hydraulics section for Mississippi River flood control at New Orleans; and chief of the hydraulics section of the third locks project in the Panama Canal Zone.

Mr. Edwards

In his new capacity with the Centennial he will coordinate a program that includes a five-year exhibit of world-famed engineering accomplishments, to be staged at the Museum of Science and Industry; a summer-long pageant that is expected to tell the story of engineering to more than a million spectators, and a convocation that will attract approximately 50,000 engineers to Chicago.

Cooperating with Edwards and Lohr, in executive direction of the project, is Charles F. Kettering, General Motors research leader.

Coincident with Edwards' appointment, Lohr also announced the heads of two of the Centennial convocation committees.

Howard F. Peckworth, managing director of the American Concrete Pipe Association, was named chairman of the coordinating committee on general arrangements; and G. Donald Kennedy, assistant to the president, Portland Cement Association, was named chairman of the committee on technical programs. Both are Chicagoans.

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CENTENNIAL OF ENGINEERING — 1952

Major Lenox R. Lohr

Addressing the Annual Fall Dinner Meeting of Western Society of Engineers, Major Lenox R. Lohr, president of the Centennial of Engineering, explains the philosophy underlying the event and announces the plans that are being developed for the Centennial.

Why, with less than 7 per cent of the world's population, have we in the United States over a third of the world's goods? Because we have had a century of engineered progress. But, before I elaborate on that theme, let us have a flash-back.

The vital part which engineers have played in producing our national prosperity and our high standard of living is little understood. Ethical standards have prevented engineers from advertising their achievements. Their services are not purchased by the general public as are those of doctors and lawyers, but are largely confined to corporations where their efforts are submerged by sales departments which focus on public approval of the product and to universities where alumni are often more interested in football teams.

While doctors, scientists, and politicians are typed in the public mind, the engineer as a personality has been intangible, or erroneously conceived as the janitor in an apartment house, a locomotive driver with a striped hat, or a surveyor in high boots. The engineer is basically an economist who utilizes scientific laws to produce structures and machines which are reliable and efficient, at the lowest cost and with the greatest conservation of material. While engineers constitute only three-tenths of 1 per cent of our population, their contribution to our national well-being and progress in peace and war has been out of all proportion to their number.

Before the advent of the engineer, there were structures which are still the marvel of the modern world. Without adequate tools, or technical design, builders were forced to the extravagant use of materials and manpower, and the workmen exerted superhuman energy, frequently under the urge of the whip. Some which come readily to mind are: the Appian Way and the Roman aqueducts; the pyramids and the Sphinx of Egypt; the Great Wall of China; the inspiring cathedrals of medieval times with their complex arches, flying buttresses, and domes; the vine suspension bridges of aborigines; the temples of Angkor Vat and the Mayans; and the covered wooden bridges of colonial times. They were built, from empirical designs, by artisans who, having served an apprenticeship profited by earlier failures and simply made members stronger. Even engine builders early in the twentieth century tested their machines by running them to destruction and making broken parts larger, although these members may not have caused the failure. Our early factories for shoes, fabrics, firearms, flour and castings were largely family affairs, having a few neighbors in to assist. There was no need for engineering design, for their tools and products were simple, and mass production was still in the distant future.

The earliest engineers were military. Known as "Keepers of the King's Engines," they operated battering rams and catapults, and later manned artillery and designed and built fortifications and obstacles such as those of Vauban. Even to this day the French for shotgun is "Engin du Chase." There were no engineers in the American colonies, and it was necessary to import foreign engineers for our Revolutionary Army. Washington appreciated the need and urged

the establishment of West Point, which was founded in 1802 to train engineers for the army. It remained as such until after the Civil War. Army engineers did much of our early civil work, such as our national surveys and the building of the Baltimore and Ohio Railway. Even as late as 1848, English engineers were brought in to build the Northwestern Railroad, and its trains run on the left side of the track to this day. The first locomotives and the engine for Fulton's steamboat were imported from England, as there were no native factories capable of designing and building them.

As industries grew in complexity and our frontier expanded, the services of military engineers were not adequate to meet their growing technological needs. So in the year 1824 the Rensselaer Polytechnic Institute was founded, to aid those in civilian life in solving the problems of the coming machine age by the laws of the basic sciences rather than rule of thumb. By the year 1852 the need of an organization where engineers might share their ideas and the results of their work, was realized, so the American Society of Civil Engineers was formed. The term "civil" had another connotation from that of today, and was used to differentiate the work of the civilian engineer from that of the military engineer. At its inception the Society included all types of civilian engineers and architects. However, as with most professions, the volume of knowledge became so great that specialization was necessary and other groups branched off: architectural in 1857, mining in 1871, mechanical in 1880, electrical in 1884, and chemical in 1908. Today there are scores of societies dedicated to the many branches of engineering.

The year 1952 marks the centennial of that first association of engineers and merits a nationwide celebration. But it would be a lost opportunity if confined to engineers patting each other on the back and merely reviewing their own accomplishments to themselves. There is a powerful story that every man, woman, and child in every walk of life should know—not to evoke their praise and commendation, for that is reserved for transient heroes, but because our very national existence may depend on it.

Centennial Plans Envisage Three Major Parts

1. The greatest convocation of engineers ever assembled, with over 40 technical societies with a combined membership of over 300,000, meeting jointly in Chicago between September 3rd and September 15th, 1952. Foreign societies and prominent foreign engineers will participate, and the State Department is arranging for their entrance to this country. The many hundreds of papers delivered will cover almost every phase of engineering. Instead of being highly technical and directed to specialized groups, the discussions will be broader in scope so that members of other societies interested in activities collateral to, or outside their usual sphere may fully understand them. It will present an unusual opportunity to receive highly accurate information and direction in fields not usually accessible. Each subject will be developed with appreciation of its social and economic implications, appropriate emphasis being laid on the unique opportunity that has been open to individual initiative. They will close with a look into the future.

A volume will be printed listing all papers to be presented, and visitors may select and attend those meetings in any field in which they are interested. It will be a cafeteria of learning where the visitor may look over the array and select those which most intrigue him. There will also be a series of popular talks, frequently accompanied by demonstrations presented to the general public in non-technical language during the summer months.

2. There will be a dynamic exhibit at the Museum of Science and Industry epitomizing all engineering progress and its effects on our way of life. It will remain for five years and over eight million people will see it.

3. There will be a dramatic presentation, using all the arts of the stage, to tell the story to the general public. It will run through the summer months of 1952. It will be the story of civilization's march forward and particularly of a Century of Engineered Progress; it will be told factually and with real equipment. It will base its appeal on entertainment, and stimulating the emotions, but the story will be there so clearly depicted that the audience will deduce for itself why America is great and what we must do to preserve it and how easily it might be lost. Without propaganda, controversial or political issues, it will present the facts of our industrial growth. It will have high educational value and leave the visitor with a lasting message, vital to the future welfare of our country. Our system of free enterprise has given us what we have, and it must not be changed for a pot of gold at the end of a politician's rainbow.

These major activities will be centered in Chicago, but the celebration will be nation-wide, reaching the local sections of all participating societies, and the general public not able to attend personally. There will be motion picture films, a book for children and one for adults, a U.S. postage stamp, a commemorative medallion, radio and television programs, news stories, and a Hall of Fame for engineers.

Summary of Main Purposes of Centennial

1. Make known the contributions of the engineer in peace and war to our national progress.

2. Personalize the engineer in his true role.

3. Stimulate young men to study engineering to fill the future's great need of technically trained men in research and industry. In 1954 there will be only 17,000 technical graduates, while 30,000 will be critically needed in industry. As the peacetime use of atomic energy develops, the need may be still greater.

4. Depict the role of industry with its mass production as essential to our high standard of living, and its dependence on the engineer and management to maintain and increase our prosperity.

In every phase and activity of the Centennial its basic theme and philosophy will be emphasized. It is this: "Why, with 6 per cent of the land area and less than 7 per cent of the world's population, do we have 72 per cent of its automobiles, 58 per cent of its telephones, 45 per cent of its radios? How is it that we use and produce more than 50 per cent of many of the world's most important commodities? Why in two hundred years have we progressed from a virtual wilderness, lacking the bare necessities of

life, to a population enjoying the highest standard of living the world has ever known? The answer to this must be so clear that the man in the street and particularly school children will accept it, without discounting it as being the propaganda of big business or political gobbledygook. We have had only our share of the world's scientists, engineers, craftsmen, and natural resources.

How, then, has this been achieved?

I will suggest three reasons, but I feel that they are inadequate to explain this phenomenal growth. I hope that you will give them thought and suggest more convincing answers. They are:

1. America was settled by men of strong faith seeking freedom from the hampering restrictions of the Old World, by men with the courage to face the unknown and carve their own destiny, by men with determination to succeed by their own will and strength against adversity and hardships.

2. They came to an industrial and economic vacuum without tradition, guilds, cartels, castes and taboos to confine their endeavors, without established industries and cities moulded by a thousand years of precedent and growth. They came to a virgin country where they could plan, build, and develop according to sound natural, scientific, and economic laws, and where they could break from the strangling hand of government edict.

3. Primarily, they devised a system of government permitting free enterprise, with the hope of reward for success and the risk of loss for failure, but always with the liberty to try and try again. Free competition provided for the survival of the fittest and the spur to build more and better things for all the people at prices they could afford to pay. The Bill of Rights gave them the rights of free speech and a free press to correct faults and injustices; it gave them the sanctuary of their home and of their shop, and gave them their personal freedom. They had liberty to develop an economy and an industrial empire giving man his nearest approach to that which he had sought through the ages.

The work of the scientist, the industrial researcher, the inventor, and the engineer are so correlated and interwoven that there is only a twilight zone of distinction among them. They merit the highest praise from their fellow Americans, but that is unimportant. It is vital that the people fully understand and appreciate the role that these men play in our modern industrial world, if our way of life is to survive. The pure scientist discovers a basic law of nature, the inventor finds a practical use of it, the engineer makes it into a manufacturable product, the researcher and the engineer improve it and lastly the theory is developed. Watt did not know thermodynamics, Wright aerodynamics or Bell the theory of telephony.

Nearly every article of daily use, our clothes, food, housing, furniture, transportation, communication, and even entertainment reflects the genius of the engineer. Our highways, water supply, power plants, refineries, mines, and factories all hinge on the engineer for invention, design, tooling, production, assembly, testing, and future development.

Each of you will think of many social and economic advancements due to technology. These are typical:

The American pioneer could hardly produce enough food to maintain his family, and a catastrophe such as a drought or an Indian raid left them literally to starve. His neighbors were no better off and lack of transportation prevented supplies being brought in from more fortunate areas. The early farm tools, such as the horse-drawn reaper and the steel plow, made it possible for the farmer to support himself and one additional family in the city.

Mechanization on the farm with the tractor, the gang plow, and the self-propelled combine, produced a radical change, making it possible for the farmer to feed several families, liberating manpower to build automobiles, bathtubs, radios, and all the good things of our civilization. The internal combustion engine caused a decrease of 18,000,000 horses in the United States, each of which required five acres of tillable land for its feed. Now 80,000,000 more people can be fed, with less farm labor.

Petroleum research, by getting more usable fuel from crude oil, and better mileage from more efficient engines, has had the effect of greatly increasing our reserves of oil. The saving of fuel in one year today is greater than the total consumption not many years ago.

A depression, two wars, the spread of communism, and the growing spirit of nationalism among the underprivileged of the world have caused general unrest and a questioning of whether the way of life which has carried America so far is the best after all. It has provided an open season for those with motives of their own to try to charge it.

George Washington said on many occasions, "I have confidence in the American people doing the right thing if they know the facts." Many Americans do not appreciate the factors that have made us the most powerful nation in the world. We have not found effective means of getting the facts to them.

The Centennial of Engineering presents this opportunity, and as Mr. Charles Kettering recently remarked, "It may be a long time before we get a better one."

In recent years there have been reams of erudite and convincing arguments presented by those who recognized the need and know the facts. Speakers pound the table and proclaim that the story must be told to the grass roots or all that we have fought for will be lost. Those who know the story generally tell each other, proselytizing among those already convinced. Industry fully recognizes the danger, but some fear governmental reprisal if they become too vociferous, others produce brochures which are read by the presidents of other corporations. If these documents reach the man in the street, he is liable to consider them inspired by selfish interests, hostile to his own, and passes them off as an effort of rich men to fatten their own soft jobs. Even the most factual and ethical of mass advertising loses its power because of identical claims of superiority by competing products. Politicians, teachers, labor leaders and demagogues often become advocates of special interests or ideologies, presenting but one side of an issue, but they succeed in reaching the mass of the people.

Facts, statistically presented, may be interpreted by the public in a manner diametrically opposite to that intended.

A railroad executive recently explained to an audience that the railroads received less dollars for carrying 92 per cent of the first-class, inter-city mail than the airlines did for carrying the remaining 8 per cent of the same class. To those interested in the welfare of the rails, this would seem an obviously unfair discrimination, but the reaction of the unthinking public could well be: "I guess the airline boys are up and coming and smart enough to put it over on the railroads."

Even words are misinterpreted and have fallen into disrepute. For instance, some people think that "mass production" connotes shoddy goods, carelessly and hurriedly made to sell at a cheap price. The Centennial must show that mass production means precisely designed machines, capable of the highest accuracy, to assure interchangability of parts, which is the essence of mass production and the assembly line. It must show that "big business" is necessary for mass production and that mass production and mass distribution are necessary in order that all the people may have the good things of life, at prices they can afford to pay.

How widespread erroneous information may be is indicated by a survey among high school seniors made in March 1950 by the Opinion Research Corporation.

61 per cent thought government should closely regulate business.

59 per cent thought government control was better than competition to keep prices at a fair level.

58 per cent thought government should own banks, steel companies, and railroads.

65 per cent thought the owners received the largest share of company income.

They thought that profits were over 50 per cent and that the average return to stockholders was 24 per cent.

Again I quote Mr. Kettering: "It isn't what you don't know that is harmful; it is what you do know that isn't so."

A majority of these young people will go into industry with distorted ideas of our basic economy and a lack of knowledge of easily ascertainable facts of American business. That they can unwittingly tear down what freedom-loving and industrious men have built in America during the last 200 years is obvious. The very nature of the Centennial should appeal to the young, and it is far more important to reach those in the formative stage than those whose ideas have already crystallized. The Centennial must find the way to reach youth with the fundamental philosophy that has given them all that they have. This is easy to say, but difficult to attain and we will welcome your suggestions in developing the plan.

All activities of the Centennial, other than the convocation, will be designed to reach the general public, telling the true story of the American way of life, and the engineer's part in building and preserving it. If it succeeds, it will not be by statistics, diagrams, pie slices, or an endless row of lifeless exhibits in glass cases. It will not be by orators with complicated economic philosophies.

The facts must be presented to the people so that they reach their consciousness through their hearts rather than through their minds. A small group having knowledge of or interest in a project may be reached and swayed by reason. But the mass of people who know little and care less about an enterprise or idea, which seems foreign to their immediate interest, are reluctant to perform the necessary cerebral processes to understand it. They *can* be reached and motivated to action by an appeal to their emotions.

The effectiveness of appeals to emotion and to reason is in the order of 100 to 1, a ratio that can be substantiated. Mail response is the best method of determining the acceptance of a radio broadcast, so all letters and phone calls are carefully tabulated by the networks. A speech by Herbert Hoover on the State of the Nation brought 2,998 replies. Two talks on the work of the United Nations produced 1030 and 45, respectively. The largest number of responses ever received on a serious program, a religious one, was 10,045.

Now let's see what an emotional appeal brings forth. A bedridden child feared Santa Claus would not find his home, and the announcer asked the audience to send him a cheery card. He received 100,000 cards and 450 gifts, including train sets and bicycles. On another occasion, the audience was asked to send a greeting to a crippled child on her eighth birthday. She received the largest mail ever delivered to a single address in St. Louis. A ten-year-old infantile paralysis victim sang "Over the Rainbow" in a cracked voice and asked for support of the "March of Dimes," and 1,395,000 replies were made to this single request.

I have put special emphasis on an approach through the emotions, because it has been generally overlooked. But such an appeal does not infer a distortion of facts or juggling of truth. It means a down to earth presentation of facts so that the mass of people will readily absorb them. Those of you who saw the pageant at the Railroad Fair will remember that in scenes depicting American life there were some thirty actual historic trains, antique autos, fire engines, stage coaches, high-wheel bicycles and dozens of pieces of equipment to give reality. But in every episode there was an emotional touch—drama, pathos, thrill, suspense, nostalgia, or comedy. The audiences left with a lump in their throats and proud of being Americans. We hope to incorporate the same technique in the presentations of the Centennial.

American industry, functioning under the aegis of a constitution which guarantees liberty, is the bulwark of world stability. Our munitions, machines, and food are keeping tottering nations free. To do so may be stretching our economy to the breaking point, but we still have enough to supply our own people abundantly. We are carrying both loads, because we have had a high degree of professional education, a patent system which protected ideas, sufficient risk capital, effective research laboratories, progressive management, competition to produce the best for the least, mass production to make enough goods to go around, and a high rate of employment, with large salaries, so enough people had the means to purchase them. We have the media of mass communication so all people are aware of what is available, mass transportation to ship the goods to the remotest corner of the country, and a sharing of the profits to all who would invest. This is the story the Centennial must tell.

Your Pet Project MAY BECOME A PRIZE PAPER

Jot down the ideas you've had for a long time . . .

Maybe they'll help you think of others . . . Maybe they'll win you one of the five, $100 prizes

Here are the rules:

Any member of Society may compete regardless of grade of membership.

Papers shall not be highly technical in nature. A clear, concise and interesting coverage is desired rather than complex formulae or derivations. The subject discussed should be of general interest to engineers but should not be of a political or highly controversial nature.

All members of the Society who wish to submit papers in this contest should contact the Secretary as early as possible and not later than February 1, 1952, and request a copy of the rules governing the competition and an outline of the minimum requirements for acceptance of papers. These cover in detail the mechanical make-up which should be followed in preparing and submitting papers for the contest.

Papers must be submitted to the Secretary for acceptance by April 1, 1952. If the Secretary finds that they meet the minimum requirements of the contest, he will forward them to the Awards Committee for review. The papers will be identified by number only. The Secretary of the Society is the only person who will maintain the key to the authors.

If any paper does not comply with such minimum requirements, the Secretary will so advise the author and discuss with him the points which are below the minimum requirements. The papers which are accepted will be forwarded to the Awards Committee for judging not later than May 1, 1952. Papers which have not met the minimum requirements by that time cannot be considered for prizes.

Papers which are accepted will be judged on originality of presentation, editorial merit and value to the engineering profession.

The papers submitted must not have been previously published in substantially the same form. No copyrighted materials shall be used unless permission has been obtained and so indicated. All manuscripts, drawings, etc., are to become the property of the Society and cannot be published without the consent of the Society.

If the papers submitted are NOT of sufficient merit to warrant the award of any or all of the prizes, the Awards Committee reserves the right to award less than the five established prizes or to postpone the competition.

The winners will be announced and the prizes presented at the annual meeting of the Society in June, 1952.

WSE Executive Secretary will furnish you with a complete set of rules and minimum requirements on request.

WE'RE OFF!!

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MEMBERSHIP 120 DRIVE

APPLICATIONS (as of Nov. 26th)

TEAM STANDINGS

TEAMS	CAPTAINS	
1. Abbott, F. J. to Bailey, G. G.	Cluts, Sam	9
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3. Benson, R. L. to Bradley, B. H.	O'Leary, Tim	9
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14. Kahan, L. to Koepke, H. F.	Dare, Jim	3
15. Kohout, G. W. to Larson, P. L.	Urbain, Leo	3
16. Larson, P. J. to Lunos, I.	Hikes, Burd	2
17. Lurie, B. L. to Mann, L. B.	Reed, Ken	0
18. Manning, J. V. to Mittlemann, E.	Byrnes, Tom	7
19. Mitten, G. R. to Newling, L. H.	Wessling, Dick	0
20. Newman, H. L. to Paulson, R. A.	Wilke, Ray	10
21. Pearl, A. S. to Przyseicki, T. I.	Tansey, John	1
22. Purcell, T. V. to Rogers, D. E.	Goodell, Floyd	10
23. Rogers, E. to Scapin, J. F.	Briggs, Jim	3
24. Schad, J. A. to Schapiro, B. B.	Barlow, Jim	1
25. Sharring, F. A. to Spake, L. C.	Schuster, J. V.	2
26. Spalding, F. W., Jr. to Suson, I.	Brandon, Cliff	3
27. Sutherland, W. L. to Vallette, F. F.	Kucho, Joe	2
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LATERAL SUPPORT OF BUILDING FOUNDATIONS

Mr. Frank A. Randall, Jr., Structural Engineer, discusses methods of supporting building foundations laterally when excavation for adjacent construction presents a problem.

Since ancient times it has been a basic law that a landowner has dominion not only on the surface of his property, but also to the space above and below. Above the surface we hear of air rights which are the rights of a landowner to the use of the space above his land. He may use the surface of his land as he sees fit, though this is regulated in certain respects by statutes enacted for the common welfare of the community. Since he in turn may share in the common welfare, he may seek redress if his neighbors perform certain unreasonable acts even if these actions take place entirely beyond his property lines. Below the surface of the ground this reciprocity is not as extensive.

Property owners are sometimes protected by zoning laws from having tall buildings erected on neighboring lots, thus blocking sunlight and vision, since such laws are for the common welfare just as civil order and health and public safety must be maintained. There are no laws, however, which say that a person may not dig as deep into the ground as he wishes, such as putting several basements under a commercial building. At common law a landowner is entitled to the lateral support of his land. But if he has a building with a ten foot deep basement and his neighbor excavates to a depth of twenty feet, the new excavator is required only to provide lateral support for his neighbor's land and excavate with due care. The new excavator is not required to provide lateral support for the old footings under the ten-foot-deep basement next door, no matter how deep he chooses to excavate. In such a case, the neighbor who built first will be put to some expense to underpin his wall footings, and he has not been protected from such expense by zoning laws because the common welfare is served regardless of which landlord pays. Such is the rule under common law, and it has been upheld by the supreme courts time and again. The one important thing to remember is that due care must be made in excavating. This consideration is always paramount as in the case of Charles V. Rankin where it was said that: "Every person who is performing an act is bound to take some care in what he is doing. He cannot exercise his indisputable right without observing proper precaution not to cause others more damage than can be deemed fairly incident to such exercise." Engineers and contractors have a heavy responsibility here. More will be said about this later.

Aside from this paragraph, this article deals only with the relationships between two owners of private property. The responsibility of a municipality to adjacent properties varies in different localities and circumstances. In New York City any work below the street surface imposes a responsibility upon the city to protect adjacent land and buildings. In Illinois the street includes the space above and the land below the street surface, and under the state constitution of 1870 a city has to make good any damages to adjacent properties, due to construction in the street, less the benefits which accrue to the adjacent properties due to the improvement, subject to the decision of a jury. In a number of cases, it was decided that new subways or improved highways have enhanced the value of the adjacent property to an extent which otherwise outweighed the hardships to the properties due to the new construction.

In certain states and cities, the common law has been superceded by statutes which state that at a certain depth below the curb line, the cost of underpinning shifts to the excavator on the adjoining property. In 1855, New York City and Brooklyn enacted such a law, and it has stood up in the courts over the years. A similar law in Albany, N. Y. reads today as follows: "Provided the owners of the adjoining premises afford the necessary license to enter upon said premises, but not otherwise, whenever any excavation shall be, or shall be in-

tended to be, carried at any point to a depth of more than ten feet vertically below the surface of the lot (as defined), the owner or his agent causing such excavation to be made shall preserve from injury at his expense any walls or structures adjoining the points where such excavation is, or is intended to be, in excess of ten feet, and shall support the same by proper foundations so that the said walls and structures shall be and remain practically as safe as before such excavation was commenced. This obligation shall rest on the said owner or his agent causing such excavation to be made whether the adjoining walls or structures are down more or less than ten feet below the surface of the lot at the points in question." Where the new excavation is not intended to go more than ten feet, their statute reads to the same effect as the common law.

The theory of the New York law is that an average building will require basements or foundations only so deep, and that once an owner has invested in his structure to that depth, he will not be penalized by a neighbor who chooses to go deeper. However, it was framed 96 years ago and probably did not anticipate the modern skyscrapers which have multiple basements and very deep foundations. If they could have foreseen the development to come, it is possible that those early legislators might have chosen a greater legal depth.

The states of Indiana and Wisconsin have laws similar to New York. The Uniform Building Code of the Pacific Coast Building Officials Conference also has a similar law. Finding a confusion and misunderstanding among engineers as to the prevailing laws, the author undertook a survey to determine the prevalence of the two types of law.

The common law was found to prevail in Montgomery, Ala.; St. Paul, Minn.; Lincoln, Neb.; Pierre, S. D.; and Chicago.

A statutory law with a 12 foot legal depth was found to prevail in: Sacramento, Calif.; Denver, Colo.; Boise, Ida.; Salem, Ore.; Pittsburgh, Pa.; Salt Lake City, U.; Olympia, Wash.; Cheyenne, Wyo.; Santa Fe, N. M., as well as in Indiana and Wisconsin. The Pacific Uniform Building Code also contains this ruling. More than 600 cities have adopted this code, though whether or not the section on lateral support would stand up in the courts depends on whether the municipalities adopting it have such authority from their respective states. At any rate, a law must be observed until its illegality has been determined by the courts.

A statutory law with a 10 foot legal depth was found to prevail in: Atlanta, Ga.; Jefferson, Mo.; Albany, N. Y.; Raleigh, N. C.; Nashville, Tenn.; Richmond, Va.

It was found that the new excavator must underpin any adjacent buildings in: Boston; Jackson, Miss.; Oklahoma City; Harrisburg, Pa. (proposed). This type of law derives from the French; our common law derives from the English.

Since space does not permit listings of the many qualifying conditions in the separate cities, and in view of frequent changes, the reader is referred to the various building commissioners or city attorneys for more detailed information. It is worth while, however, to touch upon some of the conditions placed upon the excavator in certain municipalities.

Angle of Repose

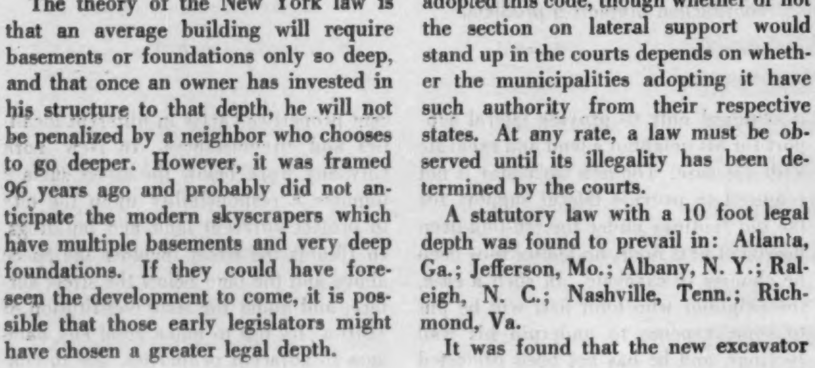
Frequently it is required that excavation for any purpose shall not extend within one foot of the angle of repose or natural slope of the soil under any footing or foundation unless underpinning or other protection is provided. The angle of repose has been defined as the slope formed by dust dry particles in forming a mound when dropped from a small height. The natural slope of soil is another matter. Engineers know that for dry sand the angle of repose is sometimes 30 degrees; while for a clay bank exposed to the elements, the natural slope can become alarmingly small. In one middle west city a builder may remove dirt on a 45 degree gradient, but where the grade is cut steeper than 45 degrees, the builder or owner is responsible to protect the neighbor against damage, and must build a retaining wall for protection. A proviso such as this circumvents controversies, and implements the quick administration of the law.

It is generally ruled that party walls shall be underpinned or protected at the expense of the party causing the new excavation to be made.

A new excavator is usually required to give reasonable notice to the owner of the adjacent property owner. In some cities this is specifically defined as 10 days, and in other cities the rule is 30 days. And the adjacent property owner is to be given reasonable license to enter on the land on which excavation is to be or is being made, or else the costs must be borne by the owner of the existing building.

Certain cities go to great length to de-

With the Common Law: Buildings A and B must pay for their own underpinnings.
With some Statutory Laws: Building A to be underpinned at joint expense of A and B.
Building C to be underpinned at expense of B.



EFFECT OF LAWS ON RESPONSIBILITY FOR UNDERPINNING

fine the legal depth. This is usually related to the curb level at the joint property line.

In an eastern city, the building code calls for all footings of buildings to be set 6 inches inside of the property lines.

During the course of excavating near a lot line, and in cases where difficulties arise, there are several questions to be answered: First, has lateral support for the land itself been provided? Second, has reasonable care been taken in making the excavation so that disturbance to the contiguous land is minimized? And third, what phenomenon may occur during excavation which are beyond the control of either neighbor?

In connection with the first question, it is incumbent upon the excavator to know the lateral earth pressures at the various depths which he must resist in an equal and opposite direction. From the standpoint of modern soil mechanics, much is not known about this matter. Nevertheless, the horizontal pressure increases with depth in undisturbed ground. There is only one way to maintain the original lateral pressure of the ground and it precludes any open excavation. The method is to drive an open ended cylindrical shell into the ground and then dig the soil out of the shell. Caisson foundations are sometimes installed in this manner, particularly where water-bearing strata are to be encountered. Steel H-beam piles displace a negligible amount of ground and so cause little lateral movement of the soil. A negative situation is created when a great number of solid (displacement) piles are driven on a site in which the neighbor's lot may be squeezed and heaved. Solid piles are sometimes now being installed after first "pre-excavating" an amount of ground which the pile would otherwise displace, thus minimizing damage to adjoining property.

Frequently open excavations are made and left open without installing any bracing or sheeting just because the soil is known to be stiff enough to stand up by itself. In such a case there is bound to be a movement of the face of the excavation. Since no lateral support has been provided, the excavator has exposed himself to a law suit by the neighbors.

Now, investigations have shown that horizontal earth pressure on sheeting and bracing placed in an open cut has an irregular shape, though sometimes parabolic, being zero at the top surface, a maximum near mid-depth, and zero again at the bottom of the cut. In practical design work, the distribution is assumed to be trapezoidal. Since the diagrams have a zero value at the bottom of the excavation, it is seen that the full horizontal pressure of the unexcavated ground has not been maintained.

Since the original state of the ground cannot be maintained while excavating, it is seen that the responsibility of reasonable care has added meaning, bringing us to the second issue. Building codes have much to say about design and construction of concrete, steel, masonry and timber, but little or nothing to say about how to dig a hole and what constitutes due care. In Denver, however, it is required that the engineer or architect in charge of the new construction shall submit his design of lateral bracing, sheathing and support for approval as part of his building plans.

Reasonable care in excavating is exercised when the digger braces the side of his cut as soon as practicable after the dirt is removed. Good planning would avoid having unbraced holes over weekends, holidays or extended periods of time. Lagging, walers and struts must be installed tightly and secured in a workmanlike manner. Diagonal braces and mud sills must be properly proportioned and jacked or wedged tight.

Lost Ground

The third item, soil movements beyond the control of the excavator, may occur in several ways. Any time that a hole in the ground is opened up, there is a tendency for the bottom of the hole to rise. This is pronounced with deep, wide holes underlain with soft clay, because the banks of the hole constitute an unbalanced load on the underlying strata near the edge of the hole. Also, there is some elastic rebound of clay. It is impossible to prevent the lateral movement of the soil which occurs below the level of excavation, and in turn the resulting heave of the bottom of the hole. The accompanying settlement of the upper adjacent ground surface is therefore unavoidable. This settlement may extend for some distance from the edge of the hole, and on this count the neighbor has no recourse.

In the time interval between the removal of dirt and placing of lagging as in the Chicago type caisson, a certain amount of ground creeps into the excavated space. Because of this movement, more volume of soil is excavated than the finished hole occupies, and the difference is referred to as "lost ground." Tunnelling presents the same problem, and in populated areas the subsequent settlement of the ground surface becomes a serious problem. Property owners along the right of way may be put to great hardships. During the construction of the Chicago subways, several large buildings were razed as they were not considered worth the expense of protection against the tunnelling operation. Several were protected by installing deep caisson foundations before the tubes approached.

In the construction of caisson foundations to rock, the water and boulder clause is a threatening contingency in the downtown business area. To seat

(Continued on Page 26)

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Highlights of the

ANNUAL FALL DINNER

AT the speakers' table are (left to right): J. Earl Harrington, A. P. Boysen, Ludwig Skog, H. P. Sedwick, Maj. Lenox R. Lohr, D. N. Becker, Gustav Egloff, John F. Sullivan, Jr., A. W. Howson, William R. Marsten and Harry J. Bartz.

WSE President, Donald N. Becker, introduces the speaker, Major Lenox R. Lohr. R. Lohr.

ABOVE: Enjoying the evening's proceedings are members of one of the founder societies.

LEFT: Members of the Board of Direction photographed with Major Lohr and Albert Reichmann, Past President and Life Member of the Western Society of Engineers.

Process Development in the Food Industries

By W. L. FAITH
Corn Products Refining Co.

CIVILIZED man has always used agricultural products as raw materials for food, clothing and many of the conveniences of life. Originally these raw materials were processed in the home; food in the kitchen, and fibers on the spinning wheel and loom. Only 35 years ago my maternal grandmother still made soap in her home. The lye, however, was purchased, and not leached from wood ashes as in former years.

The industrial revolution switched textile manufacture from the home to the factory, and many of the other home arts such as leather tanning, grain milling, and wine making eventually followed. In recent years more and more of our food processing has been carried out in industry rather than the kitchen. The slaughter and processing of meat animals was once an annual community festival in every small settlement. Home bread baking, once an actual necessity of life, has all but disappeared. Canned and dried fruits and vegetables have replaced the vegetable cellar. More recently the advent of a wide variety of frozen foods, wet and dry premixes, and even the delicatessen have turned the kitchen from a complete processing plant to more of a planning room for table decorations.

In the home all of these early processes, in which agricultural products were used, such as cooking, spinning, weaving, and soap-making, were arts rather than sciences. As these manufacturers were transferred from the home to a community enterprise, then to small shops, and then to industry as we know it today, it was only natural that a great deal of the art remained. On the other hand as industry became more competitive, not only within itself, but with other industries not considered competitive before, the need for scientific control became evident. Here, then, was a spot for the chemist and the chemical engineer. Old processes had to be improved with respect to cost, quality, and uniformity of product, all of which affect customer acceptance. At the same time development of new processes and products was essential for survival.

The problem of replacing the art of centuries with modern engineering design, construction, and operation of plants was not limited to the food industry. Non-food industries using agricultural raw materials, such as the fermentation industry, soap-making, paper manufacture, and the manufacture of drying oils were all plagued with the artisans who resisted all change. But when shrinking bank balances appeared, management had to over-ride the operating prima donnas and technical men gradually entered the picture.

Actually the chemical engineer entered the agricultural process industries by way of the back door. The huge agricultural surpluses of the early thirties led to the chemurgic movement, whose leaders called upon those miracle workers, chemists and chemical engineers, to bail agriculture out of its economic prison by developing methods of utilizing agricultural products industrially. The obvious attack was on the wastes of the food industry and other industries using raw materials from the farm not only for economic reasons but to avoid the legal penalties attending improper waste disposal methods. Here was a beach-head for the chemical engineer in the food and related industries. He accepted the challenge and his success may be measured by the inroads made into the major processing operations of the parent industry.

A complete discussion of the problems, economic and technical, which the chemical engineer faces in utilizing an agricultural product would be encyclopedic, so one can state only the major problems in a general manner and give a few examples.

Raw Material Poses Problems

In many cases economic and technical problems are interrelated but let us look first at the primarily economic problems imposed by the raw material itself. These problems, in turn, must be counter-balanced by certain advantages. Generally, the advantages of using an agricultural raw material are low cost, permanence of supply and unique properties. Uniqueness, of course, applies primarily to foods. For industrial uses, certain components may be unique, (starch or casein) but usually the advantage must be gained from low price or permanence of supply in that most agricultural products are annually renewable. On the other hand, wishful thinking or even negligence in considering possible disadvantages of agricultural products as raw materials has led to failure of numerous projects, some even in the commercial plant stage.

A major problem in non-food agricultural utilization is failure to consider fluctuations in price of the raw material. Materials used primarily as foods may

be very expensive in poor crop years, or at certain periods of any year, and available in adequate quantity and at a low price only in years of large surpluses. Nearly all grains fall in this category. Milk is even a better example. If the material is primarily for industrial use, soybeans for example, annual crop yields are somewhat less important. Farm residues or wastes, such as straw, cobs, and corn stover are seldom cheap, because they are not concentrated in any one spot. Consequently, the cost of gathering and transporting them to a processing plant may be excessive. Estimates on the cost of straw for strawboard plants in 1941[2] were $1.00 per ton to the farmer, $2.50 per ton for baling, and $1.00-$4.00 per ton for hauling depending on the length of haul. So straw didn't cost $1.00 per ton; it averaged $6.50 delivered. A similar study[1] in 1942 showed that in the concentrated farm area around Decatur, transportation of corn cobs varied from 3 cents per ton-mile (100 mile haul) to 8 cents per ton-mile (10 mile haul). On the other hand, factory residues of agricultural origin may often be sufficiently concentrated to warrant their use as raw materials. Examples are oat hulls and cottonseed hulls for furfural manufacture.

In many cases continuity of supply is a problem. A chemical or processing plant must normally run 24 hours per day at least 5 days per week, so this means a year-round supply of raw material. In one-crop-per-year areas storage must then be available for a full year's raw material supply. Many agricultural products are expensive to store because they are either perishable (fruits and vegetables) or extremely bulky (corn stalks). Several years ago a sweet potato starch plant was located in an area in Florida where three crops were expected each year. In this way storage costs could be minimized. Unfortunately the plant shut down after a brief run, ostensibly because only two crops per year could be grown. In the 1920's a plant to make paper from corn stalks was built in Danville, Illinois. This enterprise failed, possibly because of the enormous storage requirements.

Chemical and physical variation of raw materials is a problem in all industries, but where composition is a function of climatic conditions, variations may cover a wide range. An extreme example is the growing of grapes for the wine industry. The raw material variation from one vintage to another and from one area to another is an economic problem of first magnitude. In the purchase of corn for the corn wet-milling industry, one is confronted at times with supplies that are immature (soft), moldy, kiln-dried, scorched, or otherwise variant from normal supplies. The effect of these variations on process yields and operating conditions is marked and often difficult to evaluate prior to processing. In similar processing of grain sorghum, certain varieties of the grain are virtually useless because of color bodies throughout the endosperm.

Accordingly, the first problem of the chemical engineer in developing processes using agricultural raw materials is assurance of continuous raw material supply of good quality, and at a uniform and preferably low price. Since these specifications can rarely be met, the economic allowable limits must be evaluated carefully, and sufficient flexibility built into the process to handle variations within these limits.

By-Products Must Be Utilized

In the processing of most agricultural products, complete utilization of the raw material is unusual. Consequently, the utilization of by-products or disposal of waste materials is a necessity. Again using the corn wet milling industry as an example, starch is the primary product, but it represents only 65 per cent of the dry substance of the incoming corn. The remaining 35 per cent is largely protein and thus can be sold as animal feed. A second by-product is corn oil expressed from the corn germ. The prices of feed and oil are accordingly nearly as important as corn price in determining the cost of corn starch. Similarly, in testimony before the Gillette Committee, the Chairman of the Board of a large soap company said, "glycerin . . . influences your cost of soap. *Whatever* you get for glycerin affects the cost. If it is high, you have a lower cost to make a box of soap. If it is low, you have a higher cost. It is just a by-product that drops out."

In cases where salable by-products are not produced, waste disposal problems replace the by-product problems. Examples familiar to all of us are seen in vegetable canning (skins, peels, pods, fibers, and juices), leather tanneries (spent lime, tan liquors, dyes, flesh, and hair), and dairies (spillage, casein, whey, and washing compounds). Consequently, either a by-product or waste disposal problem exists in nearly every process development study in the food and agricultural industries.

Competitive Raw Materials and Products

Given a raw material that meets quality and quantity requirements and an adequate solution to the residue problem, a further economic study remains before it is worthwhile to spend money on further process development. This is a study of competitive raw materials and competitive products. In the food and agricultural industries raw material competition may come from either agricultural or non-agricultural raw materials. The importance of this factor is largely a function of the wide price swings inherent in agricultural products. A few examples will suffice.

In the manufacture of alcohol the chief raw materials in recent years have been blackstrap molasses and petroleum; grains have normally been too expensive. Yet, at present, the demand for molasses for feeding purposes has allowed considerable grain, chiefly corn and grain sorghums, to enter the industry. In World War II, wheat was the chief source of alcohol for the war program, and toward the end of the war sulfite liquor was being used as a raw material and even wood was being considered. From time to time large quantities of potatoes have become available at very low prices and in the 1949 alcohol year over one billion pounds of potatoes were converted to industrial alcohol.

This situation was brought about by the dabbling of the American government in socialistic enterprises, and is an example of political effects on the use of agricultural raw materials.

Another example of political economics is the butter-oleomargarine battle, which is a legalized fight between soybean and cotton farmers on one hand and dairy farmers on the other. The present scrap between proponents of monoglycerides as a constituent of shortening versus similar emulsifiers made from dextrose is a further example.

A very interesting example of raw material competition exists in the manufacture of nylon. Originally the chief raw materials were phenol and benzene, both derived from coal. These were replaced by a petroleum fraction, cyclohexane, and then later partially by a material of agricultural origin, tetrahydrofuran, from corn cobs, oat hulls, and cottonseed hulls. When the present emergency subsides, it is not at all improbable that butadiene, from petroleum, may be a major raw material.

Butadiene itself is an example of a product of competing agricultural and non-agricultural raw materials. During World War II, alcohol and butane, the former from grain and the latter from petroleum were the sources of butadiene for synthetic rubber (GR-S). At the end of hostilities, all alcohol-butadiene plants were shut down because they were not competitive. If they had been, the alcohol would probably have been made from petroleum.

An example of product competition is soap versus synthetic detergents. Currently synthetic detergents, largely of petroleum origin, have captured between 1/3 and 1/2 of the household soap market. Another is leather versus synthetic rubber, where the latter has replaced 35 per cent of the leather formerly used in shoe soles. A final example is in the fiber field. Several wool-like synthetic fibers have recently appeared on the market. Among these are Orlon, one of several acrylonitrile fibers, and Vicara, the corn protein fiber. Each has properties both inferior and superior to wool, allowing them to replace or supplement wool at some price. Vicara sells for $1.25 per pound; Orlon, about $3.00. High grade wool is now $3.00 per pound whereas in 1946 it was only $1.00. What, then, are the possibilities of these synthetics? At what price is each competitive with wool? At what prices are they competitive with each other? Such questions must certainly be answered before large scale manufacturing facilities are built, and at least partially before development and pilot plant funds are allotted.

Process Development Problems Unique

After the raw material and product problems of the proposed process are determined favorably, development of a technically and economically feasible process will be turned over to the chemical engineer. Here arise a variety of problems that appear singular to the food and agricultural process industries.

Let us consider the general differences between the process development problems of the food and agricultural industries and those of other well-known chemical and process industries. In the petroleum industry, the engineer handles liquids and gases primarily; in the heavy chemicals industry he usually subjects solids to high temperatures or to reaction in water solution. In the organic chemicals industry his main problems deal again with gases and liquids, at least until the final stages of the process. In the pharmaceutical industry, his problems approximate those of the organic chemicals industry except on a more complex but considerably smaller scale.

In the food and agricultural industries the engineer is largely confined to the handling of solids in slurry form. During this handling and processing he must maintain his material in a comparatively narrow temperature range and free from the effects of biochemical or other change that may affect adversely the flavor, odor, color, or taste of the product. Because of handling as a slurry, the engineer is nearly always faced with problems of milling, dewatering, and drying, in addition to other special operations to which the raw material or intermediate is subjected.

Not only is there considerable variation in lots of most agricultural raw materials, but determination of this variation is not simple. In handling proteins, for example, protein is usually determined as a factor times the Kjeldahl nitrogen. The same factor does not necessarily apply to the various fractions of the protein, so a protein balance across several steps of a process may not be too reliable. Even dry substance determinations are unreliable in many cases where a portion of the water in a sample may be held more tenaciously than some part of the dry substance.

If we add to the difficulty of characterizing a raw material, the additional problems of characterizing the product, the headaches of process development are magnified. Chemical and physical specifications of a product very often depend not only on the type of treatment but also on the time in and between various stages of the process, or even the method of handling. In those products where appearance, flavor, color, taste, and similar properties are important product specifications, observations in development and pilot plant runs must be made with care and acuity.

Translation of results directly from the laboratory to the plant can rarely be made in complex processes, and may be unreliable in simple processes. One must remember that we in the agricultural process industries seldom work with liquids or solutions where uniformity in small samples is similar to that in large lots. In the wet milling of corn, for instance, a given stream may contain insolubles such as fiber, protein, starch, and oil, together with certain soluble salts, proteins, and carbohydrates. Particle size and shape is very important in separation procedures, so the design of handling equipment may be critical.

In the laboratory time of handling may be minimized by setting material aside in a beaker to cool. After cooling, the slurry may readily be concentrated by decantation. On a pilot plant or industrial scale large volumes will not cool rapidly by convection, so cooling may require agitation of the slurry in a vessel containing cooling coils or pumping across a cooled surface. Handling the slurry in this manner may so break up the solids that subsequent filtration is difficult. Accordingly, an equipment problem arises that may not have been recognized in the laboratory.

Pilot Plant Operations

Because of the necessity of carrying out experimental work in equipment closely resembling that of the finished plant, development work usually must be done on a fairly large, and often expensive scale. Let us consider three general unit operations, filtration, centrifugation, and drying. A simple example might be the dewatering and drying of a modified (chemically treated) starch slurry. The ease of dewatering will depend, of course, on the amount and type of pretreatment, and accordingly, the amount of degradation and swelling of the granules. Normally, swelling increases with temperature so the slurry should be kept cool. Preliminary small scale studies with single plates or vacuum discs will indicate the amount and character of the cake that may be expected,

and perhaps the rates of filtration and washing. But eventually, the operation will have to be tried on equipment resembling large scale filters.

Or let us consider the case of a protein—containing slurry for which vacuum filtration is indicated. Sooner or later studies must be initiated on pilot plant models which must be run a sufficient time to determine filtration rate and its variation with time, submergence, drum speed, feed temperature and concentration and similar variables; rate of cloth blinding; amount of foaming of the filtrate (and, of course, a study of methods of minimizing foaming); effect of type of cloth; cake thickness; washing characteristics; discharge characteristics, and cake moisture. In some cases string discharge may be found advisable in which case studies must be initiated on another type of pilot plant machine. If a thin, slimy cake is obtained, precoat filters may be indicated along with subsequent studies on depth of knife cut versus filtration rate and amount of filter aid consumption. In the case of food products, however, precoating of the filter may not be premissable because of contamination of the product. Despite its drawbacks, plate- and frame pressing may be necessary. If the worst comes to the worst, one may have to go back to the addition of organic solvents to the slurry to alter the characteristics of the solid. The added expense of this operation with its requirement for closed filters and solvent recovery systems may affect the economics of the entire process more than an allowable amount.

In many cases, the dewatering operation may be carried out on a centrifuge, even though an additional load may be thrown on the drying system. Several types of batch centrifuges are available but no method of evaluation is adequate except trial on small commercial models. In the batch centrifuge, problems of imperforate versus perforate baskets, method and speed of loading, centrifuge speed, type of washing, and methods of unloading must usually be determined experimentally. In some cases continuous concentrating centrifuges that allow some washing may permit a subsequent filtration operation to be carried out with considerable ease over the original slurry.

To digress for a moment while on the subject of centrifuges, one might mention briefly some of the problems of centrifugal studies on the separation of two solids in a slurry such as the separation of starch and gluten. Here no theoretical information is available and only large scale experimentation means anything. One problem is whether to try to produce a concentrated starch stream or a concentrated gluten stream in the first pass through a centrifuge, followed by the problems of further concentration and stripping in a second-pass machine of the same or different types. In nearly all cases, an intermediate stream (middlings) is obtained in the second-pass which must be recycled to the first machine, thus altering the characteristics of the feed and hence the separation. Actual studies over a considerable period of time must usually be carried out to bring the various streams into balance and to determine the effect of raw material variations on the separations. It also must be remembered that separations also vary with centrifugal speed, amount of recycle, amount of internal washing, degree of dilution of the feed, and even machine capacity. Accordingly the cost of such studies is considerable, and experiments must be exceedingly well planned.

Drying Methods

Space permits the mention of only a little concerning the important unit operation of drying. One of the most vexing problems in drying agricultural or food products is drum drying versus spray drying. In either case very little can be anticipated. In the case of drum or roll driers, small 6-inch rolls give some indication of whether the operation will work or not but little else. Even the characteristics of the product may be difficult to duplicate on larger rolls. Furthermore, the many variations in roll design and operation require a broad experimental study. Among these variables are single, double, or twin rolls; steam pressure; roll speed; type of feed (splash, dip, spray, or valley-type); dilution and temperature of feed; flake thickness; allowable density and moisture of product; straightness of rolls; and pressures or clearance between rolls. One advantage of roll driers, particularly with valley feed, is the opportunity for further modification of the feed as it boils in the roll valley prior to drying. This possibility adds, however, to the variables to be studied, for the drier then performs more than the drying function. This is true to a greater or lesser extent in all equipment drying agricultural products.

In a similar manner, spray drying must be conducted on almost a commercial scale to determine its proper design and operating characteristics. It has been generally agreed that all variables cannot be measured in a drier less than 10 to 11 feet in diameter. Laboratory driers at best indicate only whether a material shows promise of being spray-dried and the approximate appearance of the product. In a recent publication, Marshall[3] has discussed the important variables of spray drying, so they will not be repeated.

Space does not allow a discussion of the importance of avoiding contamination, either biochemical or from foreign bodies, in food and other agricultural product processing, but even in drying operations, freedom from discolored or overheated particles is a necessary product specification. Overheating may affect either the color or taste of a product and hence its acceptability to the customer. Accordingly, the drying operation is seldom only a removal of water, but a desiccation under such conditions that other product characteristics are unchanged or at least changed moderately and uniformly.

This problem of uniformity is an extremely important one, and in many cases can be obtained only by blending of several batches of product. In many cases a product of lower quality, but uniformly so, is better accepted than a superior product of greater variation. There is no doubt that the housewife demands greater uniformity from purchased food mixes, for instance, than she does from her own cooking.

Blending itself, particularly dry blending, is still an art, but it should be susceptible to an engineering approach. At present the required horsepower, the speed and design of mixing blades, and variations of these with the quantities and physical properties of the materials to be blended are vir-

(*Continued on Page* 23)

WSE Personals

George L. Jackson has resigned as Plan Engineer of the Department of Subways and Superhighways in Chicago to accept the position of Expressway Engineer, Chicago Metropolitan Area, with the Illinois Division of Highways. In his new work, Mr. Jackson will be associated with all phases of the expressway construction program now underway in Chicago and Cook County.

Paul M. Uitti, a graduate of the Michigan College of Mining and Technology at Houghton, entered military service in October. Mr. Uitti received a bachelor of science degree in Mechanical Engineering in June, 1951.

Several other members of WSE have joined the armed forces: **Fred P. Sener,** formerly a Junior Engineer at the Commonwealth Edison Co., now is a lieutenant in the Air Force. His new address is Headquarters, Arnold Engineering Development Center, Tullahoma, Tenn. **George H. Crandell,** formerly an engineer with the Illinois Bell Telephone Company, has been called to active duty. Lt. Crandell now is Assistant Professor of Naval Science at the NROTC at Northwestern University. Another WSE member now in the Armed Forces is **John L. Verre.** Mr. Verre, who graduated from an Illinois Institute of Technology with a bachelor of science degree in Industrial Engineering, is serving in the Air Force.

During the past several weeks, **Dr. Gustav Egloff** has been on a busy round of activities. On October 19, he spoke before the student affiliates of the Chicago Section of the American Chemical Society. On October 25, Dr. Egloff spoke before the Chicago post of the Society of American Military Engineers on "The Importance of Engineers in the Military and our Economy." As part of a three-man panel on the petroleum industry, he participated in the Sixtieth Year Convocation of Drexel Institute of Technology, Philadelphia.

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Obituaries

Frank T. Sheets, 61, president of the Portland Cement Association since 1937 and nationally known highway engineer, died suddenly November 3 in Passavant Hospital, Chicago.

Mr. Sheets joined the Association in 1933 as consulting engineer with a background of 12 years as chief highway engineer and superintendent of highways for the state of Illinois. For four years prior to his election as president of the Association, he served as consulting engineer and director of development for the PCA.

Frank V. Carroll, 63, chief engineer of Inland Steel Co. from 1927 to 1949, died of a heart attack recently.

A member of the Western Society of Engineers and the Association of Iron and Steel Engineers, Mr. Carroll was among the best known steel engineers in the area.

During his 30 years with Inland, the company underwent its greatest growth, from 1,750,000 to 3,400,000 tons of annual production. He saw the construction of two continuous hot strip mills and completed the integration of the company's supply of raw materials.

In May, 1949, Carroll became consulting engineer of the company. He began his career in the industry as a draftsman in the Joliet works of the Illinois Steel Co. in 1905. Subsequently he was employed by the National Tube, Gary Tube, U. S. ordnance and Youngstown Sheet and Tube, before joining Inland's professional staff in 1921 as assistant chief engineer.

Herbert L. Woolhiser, a life member of WSE and village manager of Winnetka, Ill., since 1917, died October 7. A member of WSE since 1920, Mr. Woolhiser identified himself with the activities of the organization and the membership over this period of time.

He was a past president of the International City Manager's Association and made a distinguished record in the fields of hydraulic, sanitary and municipal engineering.

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These items are from information furnished by the Engineering Societies Personnel Service, Inc., Chicago. This SERVICE, operated on a co-operative, non-profit basis, is sponsored by the Western Society of Engineers and the national societies of Civil, Electrical, Mechanical and Mining and Metallurgical Engineers. Apply to ESPS, Chicago and the key number indicated. Prepared ENGINEERS AVAILABLE advertisements limited to 40 words, with typed resume attached may be submitted to ESPS Chicago by members of Western Society of Engineers at no charge.

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WORKS or PLANT MGR. 42. Two and one-half yrs. superintendent, designing tooling dies molds, plant layout, prod. eng. and systems of control sheet metal products. Twelve yrs. Works manager, prod. control, directing research, manufacturing methods, personnel, plant layout and planning on hearing aids. Chicago. $10,000. 218-M.W.

OFFICE ENGINEER. Ph.D. C.E. 32. Three yrs. part time instructor in soil laboratory. Some drafting. Three yrs. surveying and design work on irrigation structures for hydrological survey. Chicago. $4,000. 219-M.W.

PRODUCTION ENG. ME. 34. One yr. and one-half production controller, tooling, planning and scheduling, production records, and standard costs. One yr. resident eng., planning, installing and administrating incentive plans, methods improvements. Two and one-half yrs. investigated client firms and did detailed writing on facilities planning, production control. Midwest. $7200. 220-M.W.

PLANT ENGINEER (Construction-Maintenance Design) ME. 29. Four yds. inspected Oil Refinery equip. supervised const., administration and field supervision of const. work. $5400. Midwest. 221-M.W.

PLANT MANAGER. ME. 42. Six yrs. superintendent of mineral products plant and by-product electric power, establishment and supervision of programs, procedures and standards. Four yrs. supervising operation of power, refrigeration, heating and air condition plants. Seven yrs. supervising operation of low rent housing project. $9,000. U.S. 222-M.W.

OFFICE ENGINEER. CE. 35. Five and one-half yrs. Ass't supt. Constr. and Maint. in charge of const. of new and maintenance of old service station facilities, estimating modernization of all bulk storage facilities, construction of a pipeline terminal, loading docks, piping systems. Six mos. designing R.R. equipt. and two and one-half yrs. designing integral structures for aircraft. Chicago. $6000. 223-M.W.

STATISTICAL or MATHEMATICAL ME. 48. Nineteen yrs. steam power plant testing, all mechanical equip., made schedules for overall performance. Coordinated between operating and maintenance. Leg injury, must have desk work. Has had considerable statistical and calculating background. $3,900. Midwest. 224-M.W.

ELECT SUPERVISOR. EE. 37. Ten mos. supervising installation and maintenance of electric and electro mech. equip. for a food processing plant and for an educational institution. Some layout of control circuits. Seven yrs. as industrial electrician. Chicago. $5400. 225-M.W.

ARCH. DRAFTSMAN. 36. Fourteen mos. design and details of structures of various kinds. Two yrs. part time work as draftsman. All exp. European. Chicago. $3600. 226-M.W.

SALES ENG. 36. Four yrs. selling refractories and chemicals to steel mills. Two yrs. time study in steel mills. Four and one-half yrs. project designer of steel mill equip. Chicago. $7200. 227-M.W.

CHIEF METALLURGIST. Met. 43. Seventeen yrs. development of metallurgical equip., market research metallurgical investigations, process control, supervision of steel making in rolling mills and open hearths. Part of exp. also in non-ferous fields particularly with scientific instructions. $6500. Chicago. 228-M.W.

MAINTENANCE SUPERINTENDENT. 49. Eighteen yrs. estimating, engineering and job superintendent, setting all machines, working from 500# to 125 tons coal handling equip., power house equip., conveyor steel mill equip. Midwest. $7200. 229-M.W.

SALES ENGINEER. ME. 30. one and one-half yrs. sales of folding partitions, lead X-Ray protective materials, skylights and flashing. Four yrs. industrial engineering and processing on sheet metal products and small mech. subassemblies as well as some electronic equip. One yr., three mos. field service work on aircraft instruments. Chicago. $6000. 230-M.W.

DEVELOPMENT ENG. EE. 27. Two yrs. general development work laboratory and board. One yr. electro-mech. testing of switching and interrupting equip. Nine mos. development of Turbines and generators. One and one-fourth yrs. sales of wire products. Chicago. $4800. 231-M.W.

DESIGN-DEVELOPMENT. ME. 27. Five and one half yrs. reviewing engr. work of 5 engrs. and testing for performance, plus own dealing with domestic heating equipment. $5400. Midwest. 232-M.W.

METALLURGIST. Met. 29. Two and one-half yrs. perform investigations on customer claims, plant part failures and production problems of various types and to write reports summarizing and discussing results of investigations. $4500. Midwest. 223-M.W.

DESIGNER. 31. Six yrs. layout and design of R.R. tank cars, detail of power plant used for driving models of buses and auxiliary equip. $6,000. Midwest. 234-M.W.

CIVIL ENG. CE. 25. Three mos. surveyor in field giving line and grade for sanitary and storm water systems. Four mos. board work on highway. $4200. Midwest. 235-M.W.

CONSTRUCTION SUPT. ME. 33. Two yrs. installation of refractory materials, large steam generators, incinerators. Field engineering in connection with smoke abatement problems, maintenance of refractory linings. Six yrs. office and field engineering and construction of pipeline terminals, river and lake terminals, warehouse and office building design, const. Seven yrs. elec-

trical and mill wright maintenance and steel plant. $6500. Midwest. 236-M.W.

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FIELD ENG. C.E. 22. Seven mos. Jr. Designer, elementery design of concrete structures and design of sewer. Four mos. partner, estimate, sell, build new and rebuild concrete foundations, driveways, floors, stairs and sidewalks. $5-200. Chicago. 197-M.W.

ELECTRICAL DESIGNER or LIGHTING DESIGNER. M.S. 26. Five yrs. industrial electrical distribution. $5700. Midwest. 205-M.W.

FIELD ENG. or APPRAISAL. C.E. 37. Sixteen mos. price trending on mechanical equip. Thirty four mos. interpret drawings and specifications for building contractors, check proposals from contractors. $4800. Midwest. 206-M.W.

CIVIL ENG. C.E. 24. Two and one-fourth yrs. estimating, design and detailing of misc. ironwork and piping hangers for large steam generating stations. $4750. Midwest. 198-M.W.

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IND. ENG. MGR. 26. One yr. assistant production manager, Production control, time study, and general engineering. Nine mos. Jr. Eng. production control and standard costs, personnel work. $4200. Chicago. 213-M.W.

PROCESS PROD. ENG. M.E. 26. Eight mos. engineer, purchasing, management, layout, estimating, drafting and designing. Four mos. welding and burning alloy castings. Four yrs. Jr. Eng. purchasing layout, estimating, designing and drafting. $4800. East or Midwest. 214-M.W.

PLANT ENG. C.E. 49. Eight yrs. plant engineer charge of engineering, maintenance and construction estimating, expediting and project engineer. Three yrs. in charge of engineering design of concrete accessories. $8,000. Midwest. 215-M.W.

Crerar Library
Notes and News

December 3 was the fourth anniversary of the lease which provides the space for WSE's present headquarters. This was no ordinary lease; it was, rather the first formal result of an idea. The idea was the building of a center for the affiliation of scientific and professional societies with the Crerar Library. The vast expansion of scientific research in recent decades makes the library as necessary to continued progress as electric power to industry, or uranium to the atomic pile. Uncounted chemists, physicists, engineers, physicians and other scientific men have pushed out the frontiers of our knowledge of the physical world, not only through these recent decades but also through centuries before. And the library is the record of their findings.

The pioneering spirit of WSE has made a major contribution to the growth of the science center idea. With the largest societies in engineering, chemistry and medicine now in Crerar buildings, the success of the venture seems assured. There are symptoms of growing pains in the WSE region, however, and the Library is studying ways of making additional space available as other societies express interest in locating at 84 or 86 East Randolph Street. As an emergency measure, a small area has been made available on one of the stack landings to serve as storage space for WSE files and records.

* * *

One form of assistance given to industry in foreign countries by ECA, is the supplying of technical information in response to queries relating to manufacturing problems. The Department of Commerce administers the program for ECA. The John Crerar Library's Research Information Service is one of the centers providing technical information, under contract with the Department of Commerce.

* * *

The Library has recently suffered serious loss of some of its technical staff. Ellis Mount, technology librarian (physics), is now technical librarian, General Electric Plant in the Aircraft Nuclear Propulsion Project at Oak Ridge. Tom Simms, consultant (metallurgy) in Research Information Service, left the first of December to accept a supervisory position in the Materials Control Laboratory of the Jet Parts Plant of Hotpoint. And on December 8, Ed Quinn, technology librarian (chemical engineering) left Crerar to become reference librarian at the University of Florida. We like to have alumni scattered around the country, but we prefer to keep our graduating classes smaller than that in 1951.

Process Development
(*Continued from Page* 18)

tually unknown. Much of this lack of information may be attributed to poor sampling methods and inadequate analytical procedures. The analytical chemist, therefore, has much to do to aid the chemical engineer in his solution of these problems.

From the foregoing discussion, I believe it is obvious that the part of the chemical engineer in process development in the food and agricultural industries is a demanding one. Certainly those in the field will never become bored.

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3 Marshall, W. R., Jr., and Seltzer, Edward, Chem. Eng. Progress, *46*, No. 11, 575-584 (1950)

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Reviews of Technical Books

Available at WSE Headquarters

Hardness Testing

Indentation Hardness Testing, by V. E. Lysaght, Reinhold Publishing Corporation, New York, N. Y., First edition 1949. 288 pages. $5.50.

This book describes the instruments in common use—the Brinell, Rockwell, Scleroscope, and Diamond Pyramid, as well as those used for specialized types of hardness tests. The author evaluates the advantages and disadvantages of each and gives complete specifications.

It covers the hardness field thoroughly and should prove useful to metallurgists, testing engineers, and students.

An appendix is devoted to Tables of Hardness Numbers, Conversion Tables, Specifications for Hardness Tests, and Hardness Values to aid in the selection of the most suitable steel for tools. It is well indexed.

H.P.H., W.S.E.

Strength of Materials

Strength of Materials, by James E. Boyd and Samuel B. Folk, McGraw-Hill Book Company, Incorporated, New York, N. Y., Fifth Edition, 1950. 417 pages. $4.25.

In this revision of this successful text, emphasis is placed on fundamental theory and the application of analytical mathematical processes to the strength of materials.

The new edition presents the subject matter more logically arranged, additional problems, figures, drawings, and recent developments in the field. Problems follow nearly every article. Most of them are taken directly from actual tests of materials. Sufficient experimental facts and applications are given to prepare the student for future study in design.

The utilization of fundamental ideas, physical constants, and reasonable stresses with a minimum of memory work should provide the student with a comprehensive grasp of up-to-date strength of materials.

H.P.H., W.S.E.

Films and Surfaces

Thin Films and Surfaces, by Winifred Lewis, Chemical Publishing Company, Inc., Brooklyn, N. Y. 1950. 120 Pages. $4.75.

For those interested in the metallic surfaces and thin metallic films this book provides an unusually comprehensive compilation of the available knowledge on this subject, with special reference to aluminum and its alloys.

The physical, electrical and chemical properties of metallic films as well as their production, are presented in thorough, concise, well organized manner so as to make this book valuable as a reference media.

G.H.A, W.S.E.

Cathode-Ray

Encyclopedia on Cathode-Ray Oscilloscopes and Their Uses, by John F. Rider & Seymour D. Uslan. John F. Rider, Publishers, Inc., New York, N. Y. 1950. 992 pages. $9.00.

While the title "Encyclopedia on Cathode-Ray Oscilloscopes and Their Uses" is quite all inclusive, it is believed that this tile is quite well justified by the assembly of a vast amount of data of the past 10 years which can be helpful to all who make use of this most versatile of all test instruments.

The information is very complete for the past 10 years. Some information goes back to the J. B. Johnson gas focussed tube of 1922. There is a gap in this history however, between Braun 1874 and J. B. Johnson. The work of McLean Nicholson, Dufour and others is not mentioned.

The taking of hysteresis curves is discussed on page 671 by direct deflection methods, but the more modern methods are not mentioned.

The gas focussed tube still holds the very unique characteristic over all other cathode-ray tubes of providing a ray which stays focussed throughout its entire length, all others focus at certain nodes. Perhaps this property may prove quite valuable in some future applications.

H.J.McC., W.S.E.

Engineering Mathematics

"Mathematics for Engineers," by Richard Dull and the late Raymond Dull, has just been issued by the McGraw-Hill Book Company in a new, third edition.

The third edition contains a new chapter on Dimensional Analysis and Similarity Analysis, a new chapter on Differential Equations, and other new material.

The author of the book, the late Raymond Dull, was a Charter and Life Member of the WSE. He began his revision of the book before his death in 1948 and his son has continued the revision to completion.

H.H.F., W.S.E.

WSE Applications

In accordance with the By-laws of the Western Society of Engineers, the following names of applicants are being submitted to the Admissions committee for examination as to their qualifications for admission to membership into the Society in the various grades, i.e., Student, Associate, Member, Affiliate, etc. All applicants must meet the highest standards of character and professionalism in order to qualify for admissions, and each member of the Society should be alert to his responsibility to assist the Admissions committee in establishing that these standards are met. Any member of the Society, therefore, who has information relative to the qualifications or fitness of any of the applicants listed below, should inform the Secretary's office, 84 E. Randolph St., RAndolph 6—1736.

68-83 Michael A. Powills, Jr.; Traffic Engineer I, Bureau of Street Traffic, City Hall.

69-83 George W. Blanchard, Jr.; Cable Representative, Reynolds Metals Co., 400 N. Michigan Av.

70-83 Miss Winifred M. E. Hutton, Junior Designer, Naess & Murphy, 80 E. Jackson Blvd.

71-83 Fred B. Marshall (Rein.), Owner (Structural Engineering), 11 W. Monroe St.

72-83 Albert H. Swift, Engineer, American Bridge Co., 208 S. LaSalle St.

73-83 A. R. Dayson, Structural Engineer, G. O. Neumann & Co., 790 Broadway, Gary, Ind.

74-83 Herman Balsam, General Manager-Owner, Titon Tool Works, 7 S. Dearborn St.

75-83 Anthony S. Weaver, 1251 N. California Av.,—attending Illinois Institute of Technology.

76-83 Walter J. Weaver, 1251 N. California Av.,—attending Illinois Institute of Technology.

77-83 Miss Lois A. Bey, Assistant Engineer, Underwriters' Laboratories, Inc., 207 E. Ohio St.

78-83 Eugene W. Miller, Jr., Designer & Estimator, American Bridge Co., 208 S. LaSalle St.

79-83 Claude R. Wilson, R. Renken & Co., 407 S. Dearborn St.

80-83 Martin G. Sachs, 1728 W. Estes Av.,—attending Illinois Institute of Technology.

81-83 William N. Alderman, Partner; Wright, Alderman & Martin, 134 N. LaSalle St.

82-83 Sarkis Boyajian, 520 W. 118th St.,—attending Illinois Institute of Technology.

83-83 Leonard M. Kawell, 9033 Marmora Av., Morton Grove, Ill. —attending Illinois Institute of Technology.

84-83 William C. Wright; Partner, Wright, Alderman & Martin, 134 N. LaSalle St.

85-83 William E. Henneman, Sales Engineer, F. J. Stokes Machine Co., 20 N. Wacker Dr.

86-83 David C. Engle, 10246 S. Bell Ave.—attending Illinois Institute of Technology.

87-83 Albert Flyer, 721 W. Belmont Av.—attending Illinois Institute of Technology.

88-83 Robert O. Johnson, 1223 W. Gunnison St.—attending Illinois Institute of Technology.

89-83 Frank R. Waltzer, Project Engineer, Graver Water Condition- 1400 Wrightwood Av.

90-83 Joseph P. Turner, Field Engineer, Graver Water Conditioning Co., 216 W. 14th St., New York 11, N. Y.

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92-83 Harvey H. Livingston, Senior Electrical Designer, A. J. Boynton & Co., 109 N. Wabash Av.

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Lateral Support

(*Continued from Page* 13)

the caisson on bed rock, the contractor must occasionally go through a water bearing strata which is under great hydrostatic head. When the water is pumped out as fast as it comes into the hole, the sand is swept into the hole and also pumped out. Soon a large area may be undermined. On large buildings where many caissons must be installed, the ground surface at the perimeter of the lot has been known to settle several inches. On one Chicago skyscraper, the undermining dropped an adjoining structure (resting on hardpan caissons) 2 inches and a two-story building across the alley developed several large cracks. Under the prevailing common law, these neighbors were nevertheless obliged to protect their own buildings. What has resulted is a vicious circle in which many buildings are built on expensive rock caissons for fear that a neighbor might otherwise jeopardize shallower foundations. It has been proposed that the water and boulder contingency might be avoided by driving steel H-beam piles at the bottom of a caisson excavated to hardpan.

One reason for settlement and damage to buildings, which should not be confused with lack of lateral support, is the lowering of the ground water table during construction. In exercising the property right of putting in as deep a basement as one chooses, it may be necessary to pump water out of a hole, and of necessity pumping the water out from under the neighbor's lot. When the water is removed, the intergranular pressure in the soil is increased just as though a new superimposed load had been placed upon it. The result is settlement of any foundations above and possibly cracking of the structure.

In summary, the common law provides protection for one's land, but does not protect one's buildings against deep excavations on adjoining property. The statutory law indicates an awakening to new types of construction and consideration for neighbors of lesser means. The statutory laws put the cost of underpinning on the excavator who goes below a certain depth. One writer has forecasted that such laws will in time become prevalent throughout the country.

Engineers and contractors have an important role in avoiding law suits. Careful planning and construction and a good understanding of soil mechanics are required. It is wise for the builder to consult a capable lawyer to determine his rights and to determine the proper forms of agreements for protecting neighboring structures.

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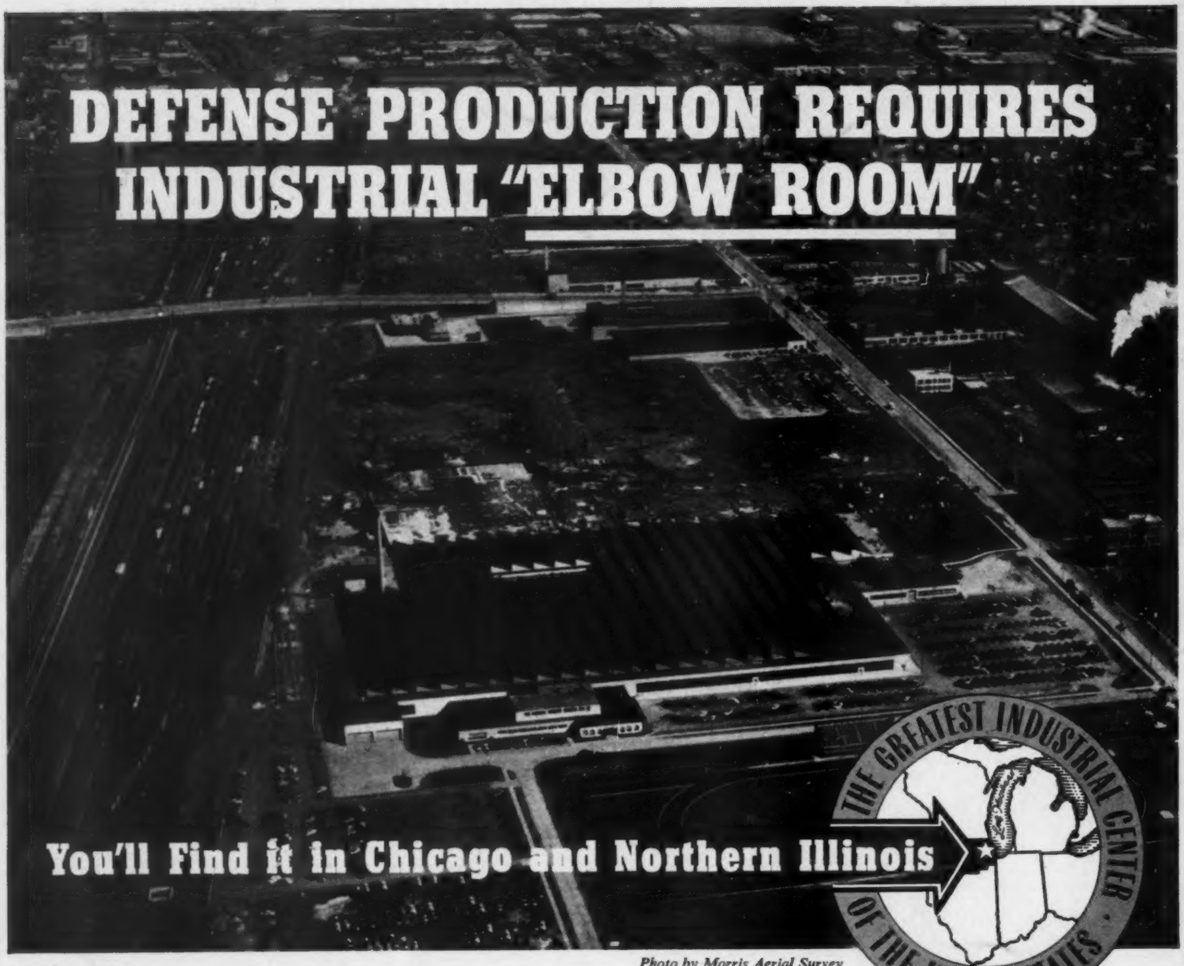

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